### Biology Genetics Unit HW Packet #3

**Name** _________________________________________ **Hour** _________

**DUE:** ______________________

**HW #1**  
**Beaker**  Data Table .......................................................... ___  
**Babies**  Drawing ............................................................... ___

**HW #2**  
**Pedigree** Data Table .......................................................... ___  
**Studies** Analysis .................................................................. ___

**HW #3**  
**Data Tables** ........................................................................ ___  
**Fast Plants** Completion ................................................................ ___

**HW #4**  
**Pedigree practice** Completion ............................................... ___

**HW #5**  
**Dihybrid** Completion ............................................................ ___

**Genetic Disorder #3** Completion ............................................ ___

**Practice 4 quiz** One trait practice ........................................... ___

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5 points possible
HW # 1 Imaginary Beaker Babies

Objective: To show the workings of the gene and chromosome and their pairing to determine the characteristics of an offspring.

Pre-lab Discussing: It must be realized that half of the chromosomes and genes an organism possesses was inherited from the female parent and the other half came from the male parent if the organism was produced sexually. This activity will walk you through the randomness of the genotypes the offspring will receive. You will begin with the parents (P1 generation) creating a child (F1 generation). You will then draw the child as your result of your chosen genes.

Procedure A:
1. Get together with your partner (spouse) at your lab station.

2. You should have 3 beakers at your lab station, one marked female (P1), one male (P2) and the other marked offspring (F1). If they are not marked, take a marker and mark each one.

   P1(parent 1)    X     P2 (parent 2)      =      F1 (offspring)

3. Each of you are going to create an imaginary beaker baby (make it up) using the characteristics listed below. Choose the letters (genotypes) you'd like your offspring to inherit and place the genes on your chromosome (be sure one of you is male and the other is a female).

   **Genotypes and Phenotypes for imaginary Beaker Babies:** DATA

   A. Sex       X = female       Y = Male
   B. Hair Color B = Black       b = blonde
   C. Eye color  E = brown       e = blue
   D. Height    T = 18 cm        t = 10 cm
   E. Size of feet F = 4 cm       f = 2 cm
   F. Mouth shape R = round      r = heart shaped
   G. Teeth     P = Sharp       p = none
   H. Body shape L = Round       l = square
   I. Blood Rh factor + = positive  - = negative
   J. Blood Type A = Type A      B = Type B     O = Type O
   K. length of mouth M = 3 cm     m = 1 cm
   L. shape of nose N =  
       n =
   M. Size of ears Z = large      z = small
   N. Size of eyes K = Quarter    k = penny
   O. Shape of head D = Rectangular d = Circle
   P. Hair texture C = curly      c = straight
   Q.
   R.
   S.
   T.
   U.
   V.
QUESTION: For hair color and eye color predict the probability of your offspring looking like their mother.

A - What is the probability of the offspring of having the same genetic makeup?
Offspring's genetic makeup comes half from dad and half from mom, so the chance of looking exactly like mom is 0%.

B - Determine the expected probabilities of the genotypes for hair color and eye color for their offspring based on your two parent options (yours and your lab partners)?

Answers will vary.

4. Cut the male and female chromosomes along the dotted lines for each genotype (not centromere) and place all the “genes” for male and female into the correct beakers marked male and female beakers.

5. Randomly pull out one of each type of gene (letter A-V) from both the male and female beakers. Use only the first of each gene drawn to form your gamete. Place it in the offspring beaker to create one complete chromosome. So, there is a mixture of male and female genes in the offspring beaker.

6. Put the two new chromosomes together by pairing up the letters (starting with A and ending with V) and record them in Data Table 1 (your child). This is how you will determine both the genotype and the phenotype for your first offspring.

7. Check to see if your child (Data Table 1) has a twin in the class. Is there anyone that has the exact same genotypes that your child has?

Procedure B:
1. Draw your child offspring (F1) from procedure A you formed in the space provided on the next page.

QUESTIONS:
1. Were all of your traits the dominant traits?
   Answers will vary.

2. Did you have a “twin” in class that had all of your same alleles (traits)?
   Answers will vary.

3. Why do you think that there was no other person just like you in class?
   Answers will vary.

4. If a trait is dominant does that mean that most of society (people) have that trait?
   No; dominant does not mean the most common. It means it is the trait that appears even with only one copy of the gene.

5. Define:
   - Allele - version of a gene
   - Trait - characteristic of an organism (hair color, blood type, height, etc.)
   - Gene - factor containing information for a trait; a portion of a chromosome that “codes” for a trait.
Eye Line

Sex

Blood Type/ Rh factor
Pedigree Studies Lab continued

**Pedigree:**
Create a pedigree using the information listed below in the space provided or on a separate sheet of paper.

BEGIN: Ron and Sandy had the ability to roll their tongues. They also had the ability to have nine offspring. The first five kids were boys. The last four were girls. Only the odd numbered offspring could roll their tongues. Their three youngest children died in a car accident at an early age. II - 1 had one son who could not roll his tongue. II-4’s family included two daughters who could roll their tongues and a spontaneously aborted son.

The son of II-1 marries and he and his wife have identical daughters unable to roll their tongues.

III-4 marries and has two sons unable to roll their tongues. The oldest son of II-7 got married and they had a stillborn daughter. Their next child, a male, was aborted and they then had identical triplet girls unable to roll their tongues.

Use "R" for the ability to roll the tongue and "r" for the inability to roll the tongue. Complete this pedigree with appropriate symbols, genotypes, shading and numbering.
HW # 3 – Fast Plants – Testing Your Knowledge of Genetics

One of the major goals of this unit is to help you become familiar with how traits are passed from one generation to the next. With this knowledge, you have been working on solving genetics problems to make predictions about what the next generation of people, plants, flies, etc. will look like. In this lab, you will be using Fast Plants to keep track of two traits - stem color and leaf color. You will begin by making observations of the seeds you planted a few days ago. Using these observations, you should be able to review your skills in solving monohybrid problems as well as practice your newly acquired ability to solve dihybrid problems. Good luck!

Monohybrid – Stem Color Only
1. Observe the P1 plants. What color stem do these plants have? ___ purple ___

2. Observe the P2 plants. What color stem do these plants have? ___ green ___

3. P1 plants were crossed with P2 plants. Their offspring are referred to as F1. Observe the F1 plants. What color stem do these plants have? ___ purple ___

4. Based on your observation, which stem color is dominant? ___ purple ___

5. What letter could you use to represent stem color? ___ Pp ___

Which letter would represent green stems? ___ p ___

Which letter would represent purple stems? ___ P ___

6. Based on your observations, what is the genotype for a P1 plant’s stem color? ___ PP ___
7. Based on your observations, what is the genotype for a P2 plant’s stem color? pp

8. In the space below, make a Punnett Square to show a cross for stem color between a P1 plant and a P2 plant to produce the F1 generation.

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>Pp</td>
<td>Pp</td>
</tr>
<tr>
<td>p</td>
<td>Pp</td>
<td>Pp</td>
</tr>
</tbody>
</table>

9. What is the genotype for the stem color of all F1 plants? Pp

10. Based on your cross, could an F1 plant have any other genotype? no

Does your answer match your observations of F1 plants? yes

11. Two F1 plants were crossed. Their offspring are referred to as the F2 generation. In Table 1, record your observations for stem color.

Table 1 – F2 Fast Plants Stem Color Data

<table>
<thead>
<tr>
<th>Your Data</th>
<th>Class Data</th>
<th>All Classes Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Stems</td>
<td>Purple Stems</td>
<td>Green Stems</td>
</tr>
<tr>
<td>Green Stems</td>
<td>Purple Stems</td>
<td>Green Stems</td>
</tr>
</tbody>
</table>

12. In the space below, cross an F1 plant with another F1 plant for stem color to produce the F2 generation.

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>Pp</td>
<td>Pp</td>
</tr>
<tr>
<td>p</td>
<td>Pp</td>
<td>pp</td>
</tr>
</tbody>
</table>
13. Out of 4 offspring, how many would you expect to have green stems? 1

Out of 4 offspring, how many would you expect to have purple stems? 3

What percent of the offspring are expected to have green stems? 25%

Does this match the data for all of the classes combined? answers will vary

How many plants were counted for all of the classes combined? answers will vary

How many would you expect to have green stems? answers will vary

**Monohybrid – Leaf Color Only**

14. Observe the P1 plants. What color leaves do these plants have? yellow

15. Observe the P2 plants. What color leaves do these plants have? green

16. P1 plants were crossed with P2 plants. Their offspring are referred to as F1. Observe the F1 plants. What color leaves do these plants have? green

17. Based on your observations, which leaf color is dominant? green

18. What letter could you use to represent leaf color? Gg

What letter would represent green leaves? G

What letter would represent yellow leaves? g
19. Based on your observations, what is the genotype for a P1 plant’s leaf color? \(gg\)

20. Based on your observations, what is the genotype for a P2 plant’s leaf color? \(GG\)

21. In the space below, make a Punnett Square to show a cross for leaf color between a P1 plant and a P2 plant to produce the F1 generation.

\[
\begin{array}{c|c|c}
G & G \\
\hline
\text{g} & \text{Gg} & \text{Gg} \\
\text{g} & \text{Gg} & \text{Gg} \\
\end{array}
\]

22. What is the genotype for the leaf color of all F1 plants? \(Gg\)

23. Based on your cross, could an F1 plant have any other genotype? \(\text{no}\)

Does your answer match your observations of F1 plants? \(\text{yes}\)

24. Two F1 plants were crossed. Their offspring are referred to as F2 generation. In Table 2, record your observations for leaf color.

**Table 2 – F2 Fast Plants Leaf Color Data**

<table>
<thead>
<tr>
<th>Your Data</th>
<th>Class Data</th>
<th>All Classes Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Leaves</td>
<td>Yellow Leaves</td>
<td>Green Leaves</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
25. In the space below, make a Punnett Square to show an F1 plant crossed with another F1 plant for leaf color to produce the F2 generation.

<table>
<thead>
<tr>
<th>G</th>
<th>g</th>
</tr>
</thead>
<tbody>
<tr>
<td>GG</td>
<td>Gg</td>
</tr>
<tr>
<td>Gg</td>
<td>gg</td>
</tr>
</tbody>
</table>

26. Out of 4 offspring, how many would you expect to have green leaves? 3

Out of 4 offspring, how many would you expect to have yellow leaves? 1

What percent of the offspring are expected to have yellow leaves? 25%

Does this match the data for all classes combined? answers will vary

How many plants were counted for all classes combined? answers will vary

How many would you expect to have yellow leaves? answers will vary

**Dihybrid – Stem Color and Leaf Color Together**

27. Based on your observations, what is the genotype for stem color and leaf color of a P1 plant? PPgg

28. Based on your observations, what is the genotype for stem color and leaf color of a P2 plant? ppGG

29. In the space below, make a Punnett Square to show a cross for stem color and leaf color between a P1 plant and a P2 plant.

<table>
<thead>
<tr>
<th>pG</th>
<th>Pg</th>
</tr>
</thead>
<tbody>
<tr>
<td>PpGg</td>
<td></td>
</tr>
</tbody>
</table>
30. What should the *genotype* be of all F1 plants? PpGg

What should the *phenotype* be of all F1 plants? purple stems and green leaves

31. Two F1 plants were crossed. Their offspring are referred to as the F2 generation. In Table 3, record your observations for stem color and leaf color.

**Table 3 – F2 Fast Plants Stem and Leaf Color Data**

<table>
<thead>
<tr>
<th>Your Data</th>
<th>Class Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purple Stem</td>
<td>Purple Stem</td>
</tr>
<tr>
<td>Green Leaves</td>
<td>Green Leaves</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>All Classes Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purple Stem Green Leaves</td>
</tr>
</tbody>
</table>

32. In the space below, make a Punnett Square to show a cross between an F1 plant with another F1 plant for stem color *and* leaf color to produce the F2 generation.

```
<table>
<thead>
<tr>
<th></th>
<th>PG</th>
<th>Pg</th>
<th>pG</th>
<th>pg</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG</td>
<td>PPGG</td>
<td>PPGg</td>
<td>PpGG</td>
<td>PpGg</td>
</tr>
<tr>
<td>Pg</td>
<td>PPGg</td>
<td>PPgg</td>
<td>PpGg</td>
<td>Ppgg</td>
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<tr>
<td>pG</td>
<td>PpGG</td>
<td>PpGg</td>
<td>ppGG</td>
<td>ppGg</td>
</tr>
<tr>
<td>pg</td>
<td>PpGg</td>
<td>Ppgg</td>
<td>ppGg</td>
<td>ppgg</td>
</tr>
</tbody>
</table>
```
33. Out of 16 offspring, how many would you expect to have:

- Purple stems and green leaves? __9/16________
- Purple stems and yellow leaves? __3/16________
- Green stems and green leaves? __3/16________
- Green stems and yellow leaves? __1/16________

What percent of the offspring are expected to have green stems and yellow leaves? __6.25%________

Does this match the data for all classes combined? __answers will vary__

How many plants were counted for all classes combined? __answers will vary__

How many would you _expect_ to have green stems and yellow leaves? __answers will vary__
Pedigree Practice WS #4

For each pedigree you must number each individual within a generation from right to left as I₁, I₂, etc. Each individual must have a genotype written, remember if you are not absolutely sure of a genotype put a '?’.

1. This is a pedigree for nearsightedness (recessive) in humans. Use the symbols N and n to give the genotype of each of the following.

```
1. N? N? nn Nn
   N? N? Nn Nn
   nn N? N?
```

2. This is a pedigree for fructosuria (recessive). Use the symbols F and f to give the genotypes of each of the following.

```
2. ff F? Ff
   F? Ff Ff Ff Ff Ff Ff
   ff F? F?
```
This is a pedigree for cystic fibrosis (recessive). Use the symbols C and c to give the genotypes of each of the following.

II

If II₃ and II₄ were to have another child what are the chances that this child would have cystic fibrosis? 1/4

STINKER THINKER CHALLENGE - CAN YOU DO IT?
3. This is a pedigree for achondroplasia (dwarfism) which is a dominant disorder. Use the symbols A and a to give the genotypes of each of the following.

Having 2 dominant genes is lethal for achondroplasia.
This is a pedigree for Hemophilia - Sex linked

1. 

II 

III 

4. This is a pedigree for color blind (X-linked):

II 

If II₃ and II₄ have another child what are the chances that they will be color blind?

2/4
Blood Genetics
Give the Genotype of each person

AB =
A =
B =
O =

16
Dihybrid Genetics Worksheet #5

A. A dominant purebred long-stemmed, hybrid red rose mates with a short-stemmed white rose.

1. Dominant = long stems  Dominant = red
   Recessive = short stems  Recessive = white

2. L = long  R = red
   l = short  r = white

3. Mom = LLRr  Dad = llrr

4. LR  Lr  Lr  LR  Ir  Lr  lr  lr  lr

5&6.

7. What are the possible genotypes of the offspring?
   LlRr, Llrr

What are the chances for the different offspring?
1/2 or 50% of offspring will be long-stemmed and red.
1/2 or 50% of offspring will be long-stemmed and white.
B. In honeybees, black body color is dominant over yellow body color. Short bodies are dominant over long bodies. Cross a purebred black, long bodied male bee with a female bee that is recessive for both traits.

1. Dominant = black
   Recessive = yellow

2. Dominant = short body
   Recessive = long body

3. B = black  \( S = \text{short} \)
   \( b = \text{yellow} \)  \( s = \text{long} \)

4. Mom = \( bbss \)  Dad = \( BBss \)

5&6.

5. \( Bbss \)

6. \( Bbss \)

7. What are the genotypes? \( \text{only } Bbss \)

How many are there? \( \text{one} \)

What are the phenotypes? \( \text{only black long bees} \)

What is the chance that they will have a black short bodied bee? \( 0/1 \) (no chance).

In a complete sentence, explain what type of body their offspring can have.

One hundred percent of the offspring will be black long-bodied bees.
C. In fruit flies, red eyes are dominant to magenta eyes. Long wings are dominant over short wings. A hybrid red eyed, short winged male is bred to a magenta eye hybrid long winged female.

1. Dominant = Red eyes  Dominant = Long wings
   Recessive = Magenta eyes  Recessive = Short wings

2. R = red  L = long
   r = magenta  l = short

3. Mom = rrLl  Dad = Rrll

4. \[\text{Diagram showing possible combinations of inheritance}\]

5&6. 

<table>
<thead>
<tr>
<th>rL</th>
<th>rl</th>
</tr>
</thead>
<tbody>
<tr>
<td>RL</td>
<td>rl</td>
</tr>
<tr>
<td>RrLl</td>
<td>Rrll</td>
</tr>
<tr>
<td>rrLl</td>
<td>rrll</td>
</tr>
</tbody>
</table>

7. List the chances for the various offspring.

1/4 red eyes and long wings
1/4 red eyes and short wings
1/4 magenta eyes and long wings
1/4 magenta eyes and short wings
D. A man with type "AB" blood and is homozygous Rh (+) marries a woman that is heterozygous type "B" blood and is Rh (-). Solve this as a dihybrid problem.

1. Dominant = A and B  Dominant = Rh+
   Recessive = o  Recessive = Rh-

2. A = blood gene A  + = Rh+
   B = blood gene B  - = Rh-
   o = blood gene o

3. Mom = Bo--  Dad = AB++

4. B-  o-  B-  A+  B+  B+
   B-  o-

5&6.

\[
\begin{array}{|c|c|}
\hline
A+ & AB+- & Ao+- \\
B+ & BB+- & Bo+- \\
\hline
\end{array}
\]

7. What blood type(s) and Rh factors could the offspring have?
   
   1/4 AB+
   1/4 A+
   2/4 B+
GENETIC DISORDER RESEARCH PACKET PART 3

My assigned genetic disorder is ___________________________

GENETIC DISORDER PROJECT ASSIGNMENT #3:

Answer in complete sentences. Be sure to attach a copy of your references to this homework packet.

Whenever you are sick, you want to get better as quickly as possible. Who wants to feel sick, right? Some of the medications such as cough syrup are treatments. In other words, they treat the symptoms of coughing even though you still have the flu. Other medications such as vaccines are cures which end the illness – you no longer have the flu nor will you ever get it again.

Currently, there are no cures for genetic disorders. The cause of any genetic disorder is that person’s genes. Either an entire chromosome is changed in some way or only a small part (a gene) is affected. Either way, the only way to cure a genetic disorder is to fix the chromosome or gene - in every cell in their body! Remember, there are over 1 trillion cells. There are some disorders for which there may be a cure soon. For cystic fibrosis, scientists are researching ways of inserting healthy genes into a person using a method called gene therapy. However, the use of gene therapy to cure genetic disorders is years away.

1. Why aren’t there any cures for genetic disorders?

2. What are the treatments for your assigned genetic disorder?

3. At this point in your research, you now know the symptoms, life expectancy, and treatments of this disorder. What would it be like to live with this disorder? Write a paragraph that describes what it would be like to live with your assigned genetic disorder. You may write your paragraph from the perspective of a person living with this disorder or someone who is caring for a person who has this disorder. You may need to attach a separate sheet of paper.
One Trait Crosses Practice Sheet

DISCLAIMER: BE CAREFUL EACH PROBLEM MAY BE DIFFERENT, A MONOHYBRID, A SEX-LINKED TRAIT, INCOMPLETE DOMINANCE OR MULTIPLE ALLELES (LIKE BLOOD TYPE)

1. Color in chickens is often incompletely dominant. Cross a purebred black rooster with a purebred white hen. What are the genotypes and phenotypes of their offspring?
   1. Dominant = black and white
      Blend = gray
   2. B = Black  W = White  BW = Gray
   3. Mom = WW  Dad = BB
   4. \[ \begin{array}{cc}
         B & B \\
         W & BW \\
         W & BW \\
       \end{array} \]
   5. 4/4 (100%) of the offspring will be gray with the genotype BW.

2. White eyes are a recessive X-linked trait in fruit flies. Cross a hybrid red-eyed female fruit fly (Drosophila melanogaster) with a male white-eyed fruit fly. What are the genotypes and phenotypes of their offspring?
   1. Dominant = Red eyes
      Recessive = White eyes
   2. R = Red  r = White
   3. Mom = X^R X^r  Dad = X^r Y
   4. \[ \begin{array}{cc}
         X^R & X^r \\
         X^r & X^r X^r \\
         Y & X^R Y \\
       \end{array} \]
   5. 1/2 female fruit flies will be white eyed (X^r X^r). 1/2 females will be red-eyed carriers (X^R X^r). 1/2 males will be red-eyed (X^R Y) and 1/2 males will be white-eyed (X^r Y).

3. Defective dentine is the result of a dominant allele but it is carried on the X chromosome. The allele causes the teeth to wear down rapidly and usually only stubs remain by adolescence. Assume a female who has defective dentine (she is heterozygous) mates with a male who has normal teeth. What are the genotypes and phenotypes of their offspring?
   1. Dominant = Defective dentine
      Recessive = healthy teeth
   2. D = Defective  d = healthy
   3. Mom = X^d X^d  Dad = X^d Y
   4. \[ \begin{array}{cc}
         X^d & X^d \\
         X^d & X^d X^d \\
         X^d Y & X^d Y \\
       \end{array} \]
7. $\frac{1}{2}$ females will have normal teeth ($X^D X^d$). $\frac{1}{2}$ females be heterozygous with defective dentine ($X^D X^d$). $\frac{1}{2}$ males will have defective dentine ($X^D Y$) and $\frac{1}{2}$ males will have normal teeth ($X^d Y$).

4. A heterozygous round seeded plant is crossed with a homozygous wrinkled seeded plant. What are the genotypes and phenotypes of their offspring?

1. Dominant = Round seeds
   Recessive = Wrinkled seeds

2. $R = \text{Round} \quad r = \text{Wrinkled}$

3. Mom = $Rr$    Dad = $rr$

4. $R \quad r \quad r \quad r$

7. $\frac{1}{2}$ will be heterozygous for round (Rr) and $\frac{1}{2}$ will be wrinkled (rr).

5. Muscular Dystrophy is a recessive X-linked trait. Cross a heterozygous female with a normal male. What are the potential genotypes and phenotypes of their offspring?

1. Dominant = Healthy
   Recessive = muscular dystrophy

2. $M = \text{healthy} \quad m = \text{muscular dystrophy}$

3. Mom = $X^M X^m$    Dad = $X^m Y$

4. $X^M \quad X^m \quad X^M \quad Y$

7. $\frac{1}{2}$ females will be homozygous healthy ($X^M X^M$). $\frac{1}{2}$ females will be healthy but carriers ($X^M X^m$). $\frac{1}{2}$ males will be healthy ($X^m Y$) and $\frac{1}{2}$ males will have muscular dystrophy ($X^m Y$).

6. Cross a male who is homozygous for type B blood with a female who is hybrid for type A blood. What are the potential genotypes and phenotypes of their offspring?

1. Dominant = A and B;  Recessive = o

2. $A = \text{blood gene A} \; B = \text{blood gene B}$
   $o = \text{blood gene o}$

3. Mom = Ao    Dad = BB

4. $A \quad o \quad B \quad B$

7. $\frac{1}{2}$ will be type AB blood (AB genotype); $\frac{1}{2}$ will be heterozygous type B (Bo).